

THE NUMBERS MAN

David Harding capitalised on knowledge gleaned from science and mathematics to set up a \$32bn hedge fund. *Clive Cookson* talks to him about physics, philanthropy and why he believes in paying tax. Portrait by *Benjamin McMahon*

In 1994 the Philosophical Transactions of the Royal Society, a leading scientific journal, published an unusual paper. Entitled “Making money from mathematical models”, it was authored by a young financial trader in London. His name was David Harding, he was a Cambridge physics graduate and he used the paper to lay out what he saw as the “intellectual front line” of investment research. Harding’s idea was that finance could use science to identify and exploit inefficiencies in the markets.

He was right. Today Harding is worth about £1.3bn and, in the course of putting those initial ideas profitably into action, has become one of Europe’s leading financial entrepreneurs. His privately owned investment company Winton Capital (for which he reluctantly accepts the “hedge fund” label) manages \$32bn of assets. When I take a copy

of his Royal Society publication out of my briefcase, his face breaks into a slightly mischievous smile. “I’m terribly impressed that you have a copy of my one and only scientific paper,” he says.

Harding’s tale begins with a mathematically minded boy, who became interested in investing while helping his civil servant father manage a modest share portfolio. Today, he is based at Winton Capital’s headquarters in Hammersmith – well west of the districts favoured by London’s financial community. On the approach from the Tube station, the long, low-rise building, originally constructed in the mid-20th century, looks underwhelming. A queue of people stretches outside the Job Centre that occupies the first section of the shared block.

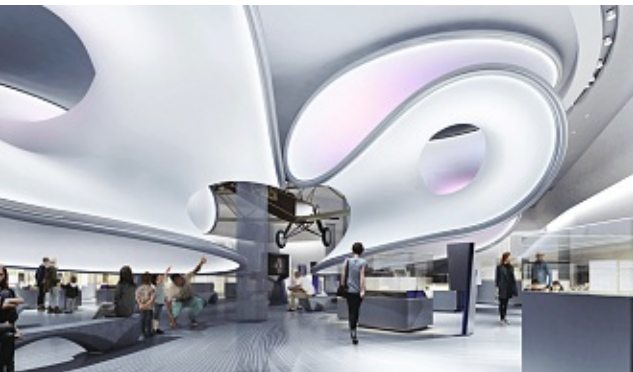
Once through Winton’s doors, however, the ground floor opens up into a spacious waiting area, its curvaceous reception desk illuminated with recessed red lights. Much of the art on display has a scientific theme, including a series of large ►



◀ Raoul Dufy prints from 1937, celebrating science and technology.

Harding's career is founded on the relentless pursuit of mathematical and scientific methods to predict movements in markets. This is a never-ending process because predictive tools lose their power as markets change; new ones are always needed. "We have 450 people in the company, of whom 250 are involved in research, data collection or technology," he says. That is equivalent to a medium-sized university physics department.

After graduating, Harding began work as a financial trader. Over five years he began to see potential profit in adopting a more mathematical approach – and, in 1987, he co-founded AHL as a commodities trading firm with two other young physicists, Michael Adam and Martin Lueck. Their success, using quantitative methods, led to AHL's purchase by Man Group in 1994. Harding struck out on his own in 1997, setting up Winton (he gave the company his middle name) with the aim of building a more substantial investment business on the back of empirical scientific research.



An architect's impression of the Zaha Hadid-designed Winton maths gallery at the Science Museum

In his 1994 paper, Harding wrote that the methods with which conventional banks and brokers make money from trading have "all the intellectual purity of selling vegetables", a phrase he uses again during our interview. As well as taking clients' fees, these methods consist essentially of selling complex derivatives at marked-up prices and of arbitrage (taking advantage of small differences in the price of financial instruments on different markets).

Harding has a different approach. He exploits failures in efficient market theory – "the idea that markets are always rational, that they perfectly reflect all knowable information and always produce in some sense the 'right' price". This theory still has a grip on western economic thinking, he says, despite much evidence that it is wrong. "It treats economics like a physical science when, in fact, it is a human or social science. Humans are prone to unpredictable behaviour, to over-reaction or slumbering inaction, to mania and panic."

The Winton investment system is based instead on "the belief that scientific methods provide a good means of extracting meaning from noisy market data. We don't make assumptions about how markets should work, rather we use advanced statistical techniques to seek patterns in huge datasets and base all our investment strategies on the analysis of empirical evidence. We conduct our

research in the manner of a science experiment – collecting and organising data, making observations and developing hypotheses and then testing these hypotheses against empirical evidence."

Harding emphasises the breadth and volume of investments involved, covering bonds, currencies, commodities, market indices and individual equities. The aim is to exploit a large number of weak predictive signals, he says: "We don't expect to find any strong relationships between data and the price of the market. That may sound counter-intuitive but if there are strong relationships, someone else is going to be exploiting those. Weak relationships are where we have a competitive advantage."

Weather strategies are one feature of Winton research, including analysis of cloud cover and soil moisture levels to predict the prices of agricultural commodities. Other important indicators, for which maths can uncover value not fully reflected in market prices, include seasonal factors and inventory levels across supply chains.

Harding admits to using science and mathematics as a marketing tool to sell Winton to institutional clients – "yes, there is certainly an element of truth in that" – but he insists that science really does control the investing strategy. "In the old days I would keep all our research terribly secret for a long time but eventually what we discovered would leak out," he says. "Today, we're engaged in a number of big and ambitious projects, which I'm forced to talk about a lot more than I would like to, because we manage money for clients." Those clients have seen a compound annual growth rate of 12.8 per cent, net of fees.

Winton is not the only hedge fund that takes a quantitative mathematical approach to investing. The best known of these funds is the \$65bn Renaissance Technologies founded in the US in 1982 by Jim Simons, whom Harding describes as one of his "three heroes" of investment, together with George Soros and Warren Buffett.

How much money is managed systematically using maths and science is impossible to estimate. "The industry is so secretive that it is really hard to tell," says another quantitative fund manager. "But I would estimate that systematic or mathematical funds amount to 15 per cent of assets in the hedge fund industry – somewhere between \$330bn and \$450bn altogether."

When I ask Harding about the use of machine learning and artificial intelligence to guide investment decisions, he bristles slightly. "There is a sudden upsurge of excitement about AI," he says, "but we have used techniques that would be described as machine learning for at least 30 years."

'Humans are prone to over-reaction or slumbering inaction, to mania and panic'

'We have used machine learning for at least 30 years'

Essentially, he says, quantitative investing, self-driving cars and speech recognition are all applications of "information engineering". Though this technology is improving fast, there is much scope for improvement. "Speech recognition still doesn't work awfully well," he observes. "If you speak clearly and simply to your iPhone it will understand what you say, but you can't chat away to a mobile phone as you would to a friend and expect it to interpret sensibly what you're saying."

Harding is now channelling some of his own wealth back into the field he came from. This month has seen the launch of the Winton Centre for Risk and Evidence Communication in Cambridge and the Winton

Bioinformatics Suite at London's new Francis Crick Institute; next month Mathematics: The Winton Gallery, one of the last architectural designs by the late Zaha Hadid, will open at the Science Museum. Each is supported by a £5m donation from Harding's charity. (His current charitable spending amounts to around £10m a year but that is likely to rise.) "I hope I'm still at an early stage of my philanthropic career," he says. "I'm quite young in comparison with most philanthropists, who tend to make their money and then give it away."

Winton Philanthropies recently joined the US-based Science Philanthropy Alliance, which promotes best practice in charitable funding of science. "By American standards, we operate on a relatively small scale," Harding says. "In some ways I find it slightly alarming that I'm quite a big fish over here in the UK."

Harding contributes far more in taxes than in charitable donations. Indeed, he sometimes refers to himself as "Britain's biggest individual taxpayer". When I ask him for evidence to support that label, he smilingly concedes: "Actually I'm probably not – but I am a very big taxpayer. Winton and its directors have paid £1bn in taxes over the past nine or 10 years."

Why do some wealthy people make so much effort to avoid taxes, including moving abroad? "I can really afford to pay taxes without it affecting my lifestyle," he replies. "I am often pressed to say that other rich people should not avoid paying taxes but who am I to morally lecture others? A lot of rich people are convinced that the government is useless and the money they spend philanthropically is fantastically good," he adds. "But I'm not convinced that I necessarily spend money better than the government through my donations." And then he heads off to a lecture by German psychologist Gerd Gigerenzer, who runs the Harding Centre for Risk Literacy in Berlin – leaving that final thought experiment behind. **FT**

Clive Cookson is the FT's science editor